

AMENDMENTS TO THE CLAIMS

1. (Currently amended) A variable optical attenuator comprising:
an input fiber for receiving an input optical signal to be attenuated;
an output fiber for outputting said attenuated optical signal;
an optical path disposed between said input fiber and said output fiber, through which said optical signal passes;
at least one pixelated liquid crystal phase changing element, disposed in said optical path such that part of said optical signal passes through at least one pixel of said at least one pixelated element; and
a drive source applied to said at least one pixel, operative to change the phase of that part of said optical signal passing through said at least one pixel.

2-4 (Cancelled)

5. (Currently amended) A variable optical attenuator according to claim-31, and wherein said at least one pixelated liquid crystal phase changing element comprises a serial pair of parallel aligned liquid crystals, orthogonally aligned such that said attenuator is insensitive to the direction of polarization of said optical signal.

6. (Currently amended) A variable optical attenuator according to claim-31, and wherein said at least one pixelated liquid crystal phase changing element comprises a serial pair of twist geometry liquid crystals, having the same overall twist angle but with the twist directions reversed, and disposed such that at the transition between said crystals, the mutual alignment of the twist structure is 90° such that said attenuator is insensitive to the direction of polarization of said optical signal.

7. (Currently amended) A variable optical attenuator according to claim-31, and wherein said at least one pixelated liquid crystal phase changing element comprises a liquid crystal divided into at least two orthogonally aligned pixels, such that said attenuator is insensitive to the direction of polarization of said optical signal.

18. (Previously presented) A variable optical attenuator according to claim 1, and wherein said at least one pixel is formed by means of at least one electrode located remotely from the area of said at least one pixel.

19. (Currently amended) A variable optical attenuator according to claim ~~31~~, and wherein said at least one pixelated liquid crystal phase changing element comprises a serial pair of parallel aligned liquid crystals with a half wave plate disposed between them, such that said attenuator is insensitive to the direction of polarization of said optical signal.

20. (Currently amended) A variable optical attenuator according to claim 19, and wherein said half wave plate is operative as a substrate for one of said at least one pixelated liquid crystal phase changing elements.

21. (Currently amended) A variable optical attenuator according to claim 19, and wherein said half wave plate is operative as an alignment layer for one of said at least one pixelated liquid crystal phase changing elements.

22. (Currently amended) A variable optical attenuator according to claim ~~31~~, and wherein said at least one pixelated liquid crystal phase changing element comprises a liquid crystal with a quarter wave plate disposed in proximity to said liquid crystal, and also comprising a reflecting surface, and wherein said input fiber and said output fiber are disposed such that light passes by reflection between them.

23. (Original) A variable optical attenuator according to claim 22, and wherein said reflecting surface is formed on the rear side of said quarter wave plate.

24. (Currently amended) A variable optical attenuator according to claim 22, and wherein said quarter wave plate is operative as a substrate for said at least one pixelated liquid crystal phase changing element.

25. (Currently amended) A variable optical attenuator according to claim 22, and wherein said quarter wave plate is operative as an alignment layer for said at least one pixelated liquid crystal phase changing element.

26. (Currently amended) An optical device comprising:

- an input fiber;
- an output fiber;
- an optical path disposed between said input fiber and said output fiber;
- at least one pixelated liquid crystal phase changing element disposed in said optical path; and

a drive source applied to at least one pixel of said at least one pixelated element, operative to change the phase of part of the cross section of light passing from said input fiber to said output fiber, wherein said device is operative as a mode-converter.

27-38 (Cancelled)

39. (Currently amended) An integrated variable optical attenuator, comprising:

- an optical fiber for inputting and outputting an optical signal;
- a pixelated liquid crystal phase changing element, disposed at an end of said fiber, such that part of said input optical signal passes through at least one pixel of said pixelated liquid crystal phase changing element;
- a substrate reflecting light transmitted through said pixelated liquid crystal phase changing element back to said optical fiber;
- at least one detector element, disposed such that it detects said reflected light not propagated back down said fiber; and

drive circuitry for controlling the phase change introduced in the passage of said part of said input optical signal through said at least one pixel of said pixelated liquid crystal phase changing element.

40. (Currently amended) A multi-channel variable optical attenuator comprising:

- a plurality of input fibers for receiving a plurality of input optical signals to be attenuated;
- a plurality of output fibers for outputting said plurality of optical signals after being attenuated, individual ones of said output fibers being aligned generally opposite individual ones of said input fibers;
- optical paths disposed between individual ones of said input fibers and said output fibers, through which said plurality of optical signals pass;
- at least one pixelated liquid crystal phase changing element, disposed in at least one of the optical paths between said at least one of said input fibers and one of said output fibers, such that part of said optical signal in said at least one optical path passes through at least one pixel of said at least one pixelated liquid crystal element; and
- a drive source applied to said at least one pixel of said at least one pixelated liquid crystal element, operative to change the phase of that part of said optical signal passing through said at least one pixel.

41-43 (Cancelled)

44. (Currently amended) A variable optical attenuator according to claim 1, wherein said change of phase is effected by rotation of an optical axis of said at least one pixel of said liquid crystal phase changing element.

45. (Currently amended) A multi-channel variable optical attenuator according to claim 40, wherein said change of phase is effected by rotation of an optical axis of said at least one pixel of said liquid crystal phase changing element.

46. (Cancelled)